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A MULTIVARIATE ANALYSIS OF THE FACTORS
AFFECTING THE RETENTION OF FIRST AND
SECOND TERM AIR FORCE ENLISTED MEMBERS

by

Scott J. Lempe

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December, 1989

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A Multivariate Analysis of the Factors Affecting the Retention
of First and Second Term Air Force Enlisted Members

by

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ABSTRACT

The purpose of this thesis was to identify the factors influencing voluntary retention behavior of first and second term Air Force enlisted members. Further, how those factors tended to differ across term of service and occupational group was examined. Data were extracted from the 1985 DOD Survey of Officer and Enlisted Personnel. Explanatory variables were grouped into tenure, demographic, cognitive, and economic categories.

Logit models were estimated for each term of service and occupational sub group. The results show that the factors affecting retention do tend to differ across term and occupation. Some, like overall satisfaction, were significant to everyone, while others, such as SRB, changed from one group to the next.

Recommendations regarding future policy implications were made along with several recommendations for future research.

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I. INTRODUCTION

A. THE IMPORTANCE OF THE STUDY OF RETENTION

The issues of retention and turnover have been the focus of a great deal of research in both the public and private sectors. One reason is that turnover has both monetary and nonmonetary implications. From a monetary perspective, turnover is expensive. Recruiting, classifying and training replacements costs money. From a nonmonetary perspective, excessive turnover also results in lost experience, lower productivity, and, in the military, reduced readiness.

For the military services, movements in retention rates, especially in first-term retention rates, also affect the ability of the All Volunteer Force (AVF) to meet its career manning requirements. The active duty military relies on new recruits for nearly all of its manpower. Without lateral entry, a decline in retention rates could create a shortage of experienced personnel. Such a shortage would have to be accommodated by modifying personnel assignments. Members would find themselves moved to accommodate needs at other locations more often and for shorter periods of time. These shortages could also reduce the overall capability of the military which would lead to a reduced pace of operations. Reduced retention rates also increase accession rates, which, while helping to

maintain overall force strength, would not solve the immediate problems caused by the shortage because it takes time to get new recruits trained, on the job, and productive.

Sustaining the AVF at current levels of operational capability then, depends on the services' ability to both recruit and retain qualified young men and women. First-term attrition and low retention result in increased recruit accessions. A key to reducing the recruiting and training costs that accompany these accessions is to improve retention.

Past research has shown that turnover rates are affected by many factors including demographic characteristics, organizational commitment, family situation, job satisfaction and job alternatives. Studies of the retention of enlisted personnel have shown that turnover in the military is affected by many of the same factors as turnover in the private sector, as well as a number of factors unique to the military such as Selective Reenlistment Bonuses (SRBs) and extended family separations. The extent to which any one factor affects turnover tends to differ between the military and the private sector. This may be due to the fact that the turnover decision in the military is different than a similar decision in the civilian community; in the military each member makes his reenlistment decision at a specific, predictable point in his career and must reenlist for a specified number of years.

The services have experimented with many different incentives in an effort to improve overall retention. Some of the reenlistment incentives applied by the services which have proven successful in the past are expanded promotion opportunities, favorable assignment locations, monetary compensation and quality of life improvements. The Air Force, for example, currently runs an assignment program known as Voluntary Stabilized Base of Preference (VSBOP). This program allows members to volunteer for assignment to certain locations with the guarantee of not moving again for at least five years. One of the goals of this program is to reduce the hardships caused by frequent moves which may affect the retention decision.

For the most part however, efforts to reduce turnover in the military have concentrated on pay and the use of enticements such as selective reenlistment bonuses and special pay entitlements. More empirical research needs to be done concerning the effect both pecuniary and nonpecuniary factors have on the reenlistment decision.

B. THREATS TO RETENTION IN THE 1990s

Relatively little research has focused on the factors that influence an Air Force member's decision to either reenlist or separate. This lack of research may well be due to the ability of the Air Force to recruit and retain qualified

people. As Table 1 indicates, Air Force retention rates have been consistent particularly with regard to the second-term where retention rates have remained in the high 70% range. The Air Force senior leadership attributes these retention rates to increased emphasis on leadership and military values, improved professional education, adequate recognition of superior performance and a reasonable quality of life for the Air Force member and his or her family [Ref. 1].

TABLE 1

ENLISTED RETENTION (Percent)					
	FY84	FY85	FY86	FY87	FY88
First-term	62	58	58	65	55
Second Term	89	78	77	79	79
Career	96	96	96	97	97

Several factors however, may threaten this success. They include a declining defense budget, an improved economy, increased competition for labor and a shrinking manpower pool. The defense budget has not increased in real terms since 1986. Indications are that, in real terms, the 1990 budget will also be reduced. While some of the reduction,

particularly in the Air Force, is due to a reduction in programs (resulting from the INF treaty and continuing negotiations with the Soviet Union), some are the result of budgetary demands to "do more with less". The FY 90 Department of Defense Manpower Requirements Report reflects an overall reduction in Air Force enlisted manpower of .8% or about 4600 people. Reduced budgets may also mean less money for things that appear to affect retention, like pay and SRBs.

Historically, an improved economy results in increased civilian job opportunities and increased competition for a labor supply which is relatively fixed in the short run. In a study of the supply of enlisted volunteers conducted in 1979, Grissmer found that unemployment elasticities range from .25 for Category III high school graduates to about .45 for Category I and II high school graduates (Mental category is a function of entrance exam scores. Category I is the top 7 percentile while Category III is the 31st to 64th percentiles) [Ref. 2]. This says that a 1% increase in the unemployment rate will cause a .45% increase in the number of Category I and II high school graduates willing to join the service. While this study addresses enlistment rather than reenlistment, it is logical to assume that decisions to reenlist will also increase as unemployment increases.

Competition for qualified people is with the other branches of the armed services as well as with the private sector. Of particular concern is the Air Force's need for high-tech skills such as computer and electronics technicians. Requirements for people with electronic and mechanical aptitudes over the next decade are predicted to grow at a faster rate than requirements for the non-technical skills (see Figure 1). The development of Air Force space operations, the continued expansion of computerization in support functions, in digital, programmable self-testing equipment and in sophisticated weapons systems will require the people with the best of skills. These are precisely the skills most in demand in both the private sector and the other services.

Also contributing to future military manpower problems is the shrinking youth population. The military services have been aware of the "Birth Dearth" for quite some time. Figure 2 shows a steady decline in the size of the male youth population through 1992. The U.S. Census Bureau projects that the number of 17 to 21 year old males will decline from a peak of 10.8 million in 1978 to 8.4 million in 1994, a decrease of 24%. According to Congressional Budget Office estimates, the military services will have to recruit one out of every seven young men ages 18 and 19 in 1990 to maintain the current force size given current retention rates. [Ref. 3]

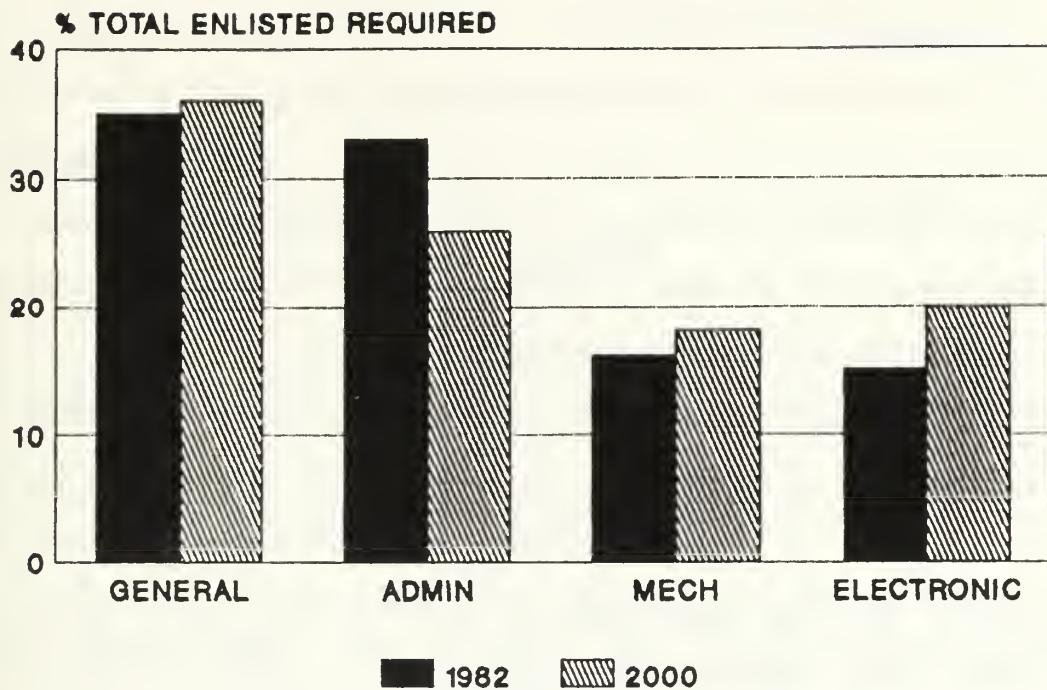


Figure 1 Enlisted Aptitude Requirements

In anticipation of this decline, the Air Force planned to insure adequate recruiting and advertising dollars, enlistment bonuses, pay comparability and strong retention programs [Ref. 4]. However, due to budgetary constraints, some of the monetary programs (enlistment bonuses, advertising programs, etc.) will simply not be funded.

C. FOCUS OF THE THESIS

The personnel management tools of Air Force planners generally fit into one of two categories; pecuniary or nonpecuniary. Since the majority of pay related policies require Congressional action, it is reasonable to expect Air

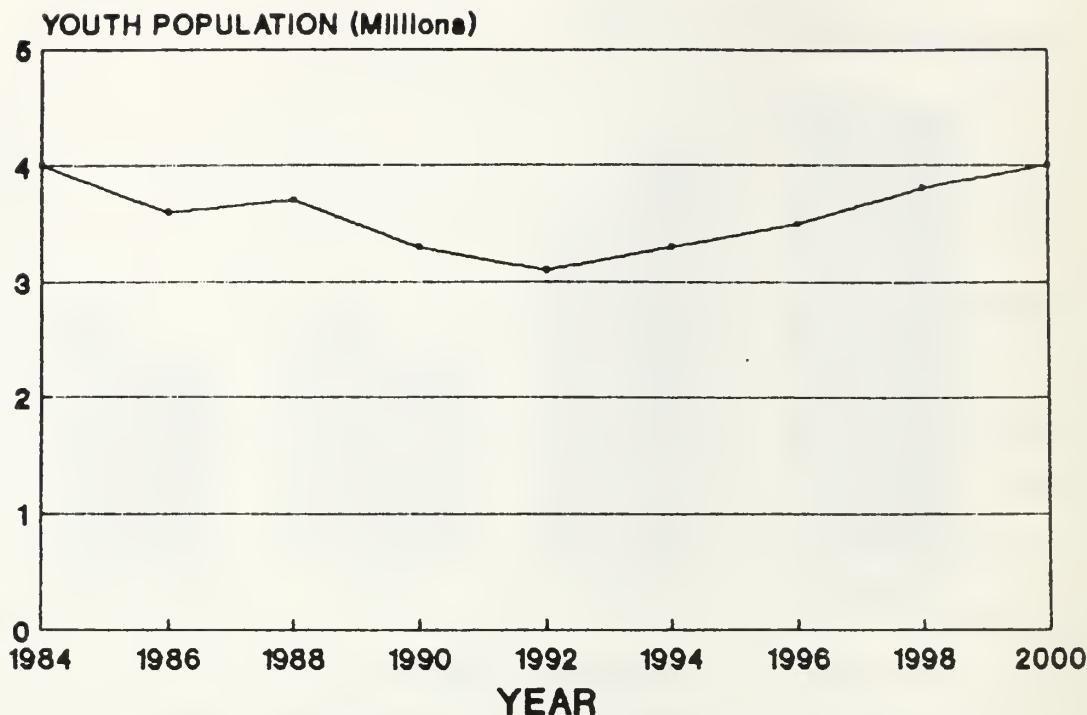


Figure 2 Eighteen Year Old Youth Population

Force policy makers to be aware of the nonpecuniary factors which most significantly impact the retention decision and tailor their efforts toward those areas.

This thesis will focus specifically on the retention of first and second term Air Force enlisted members. While several pecuniary factors will be considered, the majority of the research will concentrate on nonpecuniary factors and their influence on the retention decision.

A theoretical model of the turnover process is proposed. The model is then "fit" to data for Air Force enlisted members obtained from the 1985 Department of Defense Survey of Officer and Enlisted Personnel and the Enlisted Master File.

Multivariate analysis is used to estimate the direction and magnitude of the effect each variable has on the reenlistment decision.

Chapter II introduces the concept of turnover in both the private sector and public sector. The chapter reviews the literature relevant to the theory of turnover with emphasis on studies involving military personnel. The chapter also presents a brief discussion of human capital theory as it applies to the training investment.

Chapter III presents the methodology used to study the retention decision. The data are discussed as well as any restrictions or limitations imposed on the data for this analysis. The theoretical model chosen is explained and the categories of specific variables are introduced as they relate to the theoretical model. Finally, the chapter presents the econometric method chosen to evaluate the relative importance each variable has on the retention decision.

Chapter IV presents the results of the statistical analysis of the data. The affect each variable has on the retention decision will be discussed with reference to partial affects.

Chapter V summarizes the findings of the research and draws conclusions based on those findings. Policy recommendations are also presented as are areas for future research.

D. RESEARCH QUESTIONS

This thesis is primarily concerned with determining which factors most significantly influence the retention decisions of first and second term Air Force enlisted members. Other concerns include:

- What factors are the most important (positive or negative) to the reenlistment decision?
- Are there significant differences between the factors affecting first-term retention and those affecting second-term retention?
- Does the length of initial formal training affect retention?
- Do the factors affecting the reenlistment decision vary across occupational groups?

II. LITERATURE REVIEW

A. DISCUSSION

Porter and Steers [Ref. 5] point out that the word turnover often carries with it a somewhat negative connotation. There is, to a large extent, an underlying assumption that the reduction of all turnover is a desirable goal. There are several reasons to question this. First, from the individual's point of view, leaving an unrewarding job may result in obtaining a more satisfying one. Second, from the organization's standpoint, some of those who leave may be ineffective performers and their departures may open positions to better performers. The cost of efforts to retain an ineffective performer may well exceed the benefits. Third, given the current state of technological flux, turnover may be considered a necessary evil. It may be necessary to simply accept certain levels of turnover as the price for rapid change and increased efficiency.

There is no doubt that excessive turnover is bad for the organization, as increased recruitment and training costs must be incurred as well as, in some cases, decreases in productivity. Additionally, turnover can adversely affect the social dynamics of a work organization.

It is not surprising, then, that an extensive amount of research has been done on the turnover process in both the military and civilian sectors. This research has identified many factors that influence an individual's decision to stay in a particular job. This chapter reviews some of the past literature. First a review of literature pertaining to turnover in the civilian workplace will be presented, followed by a review of some of the more recent studies of military turnover. The chapter will conclude with a brief discussion of human capital theory as it applies to training investments.

B. TURNOVER IN THE PRIVATE SECTOR

Research on turnover in the private sector has two fairly distinct branches. Psychologists and management analysts have tended to center their studies around the relationships between job satisfaction and turnover, organizational commitment and turnover and met expectations and turnover. Economists, on the other hand, have focused on wages and the theories of human capital and job matching. I turn first to psychological studies.

Hulin [Ref. 6], for example, tested the effects of job satisfaction on turnover in a Canadian company that had been experiencing very high turnover for several years. He used surveys to measure five aspects of job satisfaction. They

included satisfaction with work, pay, supervision, promotions and coworkers.

After the company revised several personnel policies the surveys were readministered to both stayers and leavers. Not only did the results indicate significant increases in satisfaction with four of the five job descriptive indices, but they also indicated significant differences between stayers and leavers. Hulin concluded that there is indeed a strong relationship between job satisfaction and turnover.

Price [Ref. 7] considered simple correlates of turnover. He suggested a conceptual model of the turnover process aimed at incorporating the variables with the most significant correlates. His model suggested that five factors determine job satisfaction, which in turn affects turnover: pay, integration into the work group, instrumental communications, formal communication, and centralization. Price's model depicts job satisfaction combining with opportunity to leave to determine actual turnover.

One of the limitations of these studies is the use of simple correlates to infer causation. Zero order correlates do not tell the whole story. Since independent variables influence each other, the use of zero order correlates ignores the independent relative effect of each explanatory variable on turnover holding constant the other explanatory variables.

Porter and Steers [Ref. 5] took the issue of job satisfaction one step further. They hypothesized a conceptual framework centering around the role of met expectations. This model saw each individual as bringing to the employment situation his own unique set of expectations. Porter and Steers viewed job satisfaction as the total of an individual's met expectations on the job--the more his expectations were met on the job the greater was his satisfaction. Porter and Steers used a somewhat different classification of variables than earlier studies. They used four categories of factors representing "levels" in the organization. The categories are organization wide factors, immediate work environment, job related factors, and personal factors. Rather than actually perform an analysis, Porter and Steers classified the results of past studies into one of the four categories above. Based on the findings of these past studies they concluded that the issue of met expectations may indeed be central to the turnover decision. A greater number of those who stay were more likely to have experienced met expectations.

Again there may be some inherent problems with this type of comparison. First, the populations in the different studies were heterogeneous. People with different characteristics may act differently. Since the studies Porter and Steers classified were done at different times, differing

economic circumstances may have caused different behaviors. Finally, because the studies used different statistical methods, the results may not be comparable

Steers and Mowday [Ref. 8] later extended the concept of the relationship between expectations and turnover with a three part model. The model sequentially addressed job expectations and attitudes, job attitudes and intent to leave, available alternatives and actual turnover. The model suggests that intent to leave is influenced by both effective responses to the job (job satisfaction, commitment) and non-work influences (spouse concerns, family influences, life outside work).

Steers and Mowday argued that turnover is ultimately determined by a combination of behavioral intent to leave and availability of alternative job opportunities driven by labor market conditions and individual characteristics. While Steers and Mowday did add to the theoretical understanding of turnover, their model was based on past research that was largely untested empirically and, where empirical research was done, the methods tended to be less than statistically rigorous.

Another behavior or attitude that is often hypothesized to be related to turnover is that of commitment. One of the most interesting studies of commitment was conducted by Marsh

and Mannari [Ref. 9], who attempted to examine why Japanese companies have a lower turnover rates than American companies.

One of the most common explanations for this dramatic difference had been the perceived commitment of Japanese workers to their organization. As a result, Marsh and Mannari employed the theory of lifetime commitment typified by the feeling that, in Japan, a man enters an organization after school with the expectation that he will remain in that organization until retirement.

For purposes of analysis, explanatory variables were grouped into five categories including formal status, extra-bureaucratic status, social origins, attitudes and values, and lifetime commitment. They then used regression analysis rather than individual correlates to clarify the effect of lifetime commitment on turnover holding other variables constant. Their analysis yielded a number of significant variables, including sex, chance for promotion, perceived autonomy, and job satisfaction. The most significant finding was that when other variables were taken into account, lifetime commitment exerted no significant effect on turnover.

One of the advantages of this study compared with those which preceded it is that Marsh and Mannari recognized the weaknesses of previous methods of analysis. They used multiple regression techniques that allowed them to compare the influences of explanatory variables to each other and to

hold other variables constant while examining the impact of each one reducing the problems of correlation present in less involved methods.

Because of the number of different theories of turnover that emerged between the early 1950s and the late 1970s, several studies were conducted to either compare the predictive power of the theories or to group similar variables. One such study was conducted by Hom, Katerberg and Hulin [Ref. 10]. They attempted to compare the ability of behavioral, commitment, and satisfaction models to correctly predict turnover.

Hom et al tested these three general theories by first using questionnaires to collect data relative to each of the three theories. An analysis of the data showed a multiple correlation between intention to stay and job satisfaction of .57. The correlation between organizational commitment and intent to stay was .68. Finally, the behavior model showed the strongest correlation with intent to stay with R=.81.

The results of this work led Hom et al to three general conclusions. First, all three approaches to the study of turnover predicted, with high accuracy, the propensity of individuals to stay in an organization. Second, they found that the prediction of turnover becomes more accurate as individuals move closer to the actual decision point. Finally, they concluded that job satisfaction may demonstrate a more

stable relationship with turnover than do organizational commitment or social behavior models. One study (Hulin, 1966) reported significant relationships between satisfaction and turnover even with a lag of 12 months.

These results should however, be interpreted with caution for several reasons. First, the differences in the behavioral results may very well be due to the variations in statistical rigor that underly the different models and their associated methodologies. Second, using a survey to measure explanatory variables for different behavioral phenomenon may introduce different degrees of measurement bias across constructs.

A second study attempting to take an overall look at past research was conducted by Muchinsky and Tuttle [Ref. 11]. They were less concerned with comparing the predictive power of different models than they were with being able to classify the explanatory variables used in the different models into some logical structure. They grouped common predictors into five categories, job satisfaction, biodata, work related data, personal information and test scores. Reviewing previous research, Muchinsky and Tuttle noted consistent relationships between common predictors and turnover in every category except test scores.

The vast majority of evidence regarding biodata indicated reasonably consistent ability to predict turnover. While the correlations were not overly great in magnitude, most were

stable upon cross-validation. The research relating personal factors to turnover also reported consistent results. Age and length of employment were consistently and negatively related to turnover. Research relating job satisfaction to turnover was found to be the most pervasive and most consistent. Nearly every study involving job satisfaction (of which 39 were reviewed) reported a negative relationship between job satisfaction and turnover.

Research examining the relationship between work related factors and turnover was diverse in terms of variables used and measurement tools. Work unit size and repetitiveness were positively related to turnover. Receipt of recognition and autonomy were negatively related to turnover. These results led Muchinsky and Tuttle to two basic conclusions. First, turnover is indeed predictable. Second, biodata appeared to be the best predictor of turnover in terms of strength and association. Job satisfaction and personal factors were both consistent predictors of turnover.

One of the leaders in turnover research was Mobley. Mobley's work represented, in the words of Muchinsky, A major step forward in thinking of the process (of turnover) from job dissatisfaction to turnover instead repeatedly accessing the direct relationship between dissatisfaction and turnover.

Mobley's [Ref. 12] intention was to develop a more complete understanding of the withdrawal (from the

organization) process. He felt this required investigation beyond the replication of the satisfaction-turnover relationship. He attempted to identify possible intermediate links in the satisfaction-turnover process. Specifically, the model suggests that dissatisfaction leads to thoughts of quitting. These thoughts lead to rational evaluation of the expected utility of search and of the cost of quitting. If there is a perceived chance of finding an alternative (and costs aren't prohibitive) the next step would be intent to search. Intent to search then leads to actual search. Alternatives are then evaluated and compared to the current job. If the comparison favors an alternative it will stimulate intent to quit, followed by quitting.

The first attempt to evaluate this model was conducted by Mobley et al [Ref. 13]. They asked the question, does job satisfaction influence turnover through thinking of quitting, search and evaluation of alternatives and intention to quit?

Consistent with previous research, they found negative partial correlations between tenure and satisfaction and turnover and positive correlation between intention to quit and turnover. Perhaps the most significant finding was that the effect of job dissatisfaction was on thinking of quitting and intentions rather than on turnover itself.

In another attempt to test and fine-tune the Mobley model, Miller et al [Ref. 14] used hierachal regression analysis to

evaluate the relationships in the Mobley model. Their results indicated high predictive validity and moderate internal consistency. All explanatory variables except tenure were consistently related to turnover. Age and job satisfaction were negatively related to turnover while chance at obtaining an alternative job, thinking of quitting and intention to search were positively related to turnover.

A short time later Arnold and Feldman [Ref. 15] again evaluated the Mobley model. Their analysis revealed the variables with the strongest zero-order correlation with turnover were intent to search, tenure, job satisfaction, and age. The results of a multiple regression analysis supported the existence of significant relationship between the set of explanatory variables and turnover.

A useful starting point for studies by economists is Parsons [Ref. 16], who reviewed several studies of labor market turnover (Stigler, 1961, McCall, 1970, Mortensen, 1970, Gronau, 1971) and suggests that search costs, the wage dispersion and average alternative wage relative to ones own wage, will affect a worker's likelihood of seeking out and accepting another job. He points out that the models suggest that the quit probability should be negatively related to one's own current wage relative to the mean of ones alternative wage distribution. In summarizing the findings of several industrial cross-section empirical studies (Burton

and Parker, 1969, Pencavel, 1970, Parsons, 1972) Parsons notes that the expected negative relationship of quit rates and income is strongly supported. Quit rates fall as wages rise.

Parsons [Ref. 17] was later concerned with specific human capital and its relationship to quit rates. He tested the proposition that quit rates were negatively related to workers' investments in specific human capital. Specifically, large investments in specific human capital are likely to lead to reduced labor mobility since the economic cost of separation is increased. Parsons analyzed data for 47 manufacturing industries and concluded that the specific human capital concept is an important tool in the analysis of labor mobility. The most important implication of Parsons' work is that quit rates will be lower, ceteris paribus, in industries where specific human capital investments are heavy.

Finally, the job matching model argues that we may observe a positive correlation between wages and tenure and a negative association between turnover and tenure even if wage offers do not change with tenure. The argument is that individuals differ in their suitability to different firms. Those who are well suited to the firm receive higher wage offers. Those poorly suited are offered lower wages. The latter group quits with greater frequency and the former group achieves longer spells of tenure [Ref. 17]. As firm and worker learning about match quality occurs early in the worker's tenure, bad matches

terminate quickly, so those with long tenure are better matched, less likely to quit, and have higher wages. Garen [Ref. 18] points out that several studies (Mincer and Jovanovic, 1981, Topel, 1986) confirm that the probability of a job separation is much lower for those with greater tenure and experience. Garner further develops a framework to show that the matching process reduces the probability of quitting as tenure progresses because those who initially stay are better matched and earn more making it less likely that a better outside offer will arise.

Jovanovic [Ref. 19] examined the concept of job matching and turnover as a function of a worker's productivity. He assumes that for each worker a nondegenerate distribution of productivity exists across jobs. The same is assumed true for employers. Workers differ in their productivities in a given task that an employer needs to have performed. Jovanovic sees the problem as one of matching workers to jobs for which they are best suited. The Jovanovic model predicts that workers remain on jobs in which their productivity is relatively high and that they leave jobs in which their productivity is low. Further, the model predicts that each worker's separation probability is a declining function of tenure because a mismatch between a worker and a firm is likely to be detected early.

C. MILITARY TURNOVER

Research on turnover in the military has been separated from that concerned with turnover in the private sector because there are several unique characteristics of the withdrawal process in the military. First, every member of the military must make an explicit decision to remain or leave at some point during his tenure. Civilian employees are not expected to make such a specific decision (especially if they decide to stay). Also, the decision to leave, in the military, comes at a single, predictable, point in time. In the private sector an employee may intend to quit but be uncertain about when. Reenlistment in the military also means an obligation to remain for a fixed term. Consequently, the decision to reenlist carries greater commitment than does the decision to remain on the job in the private sector. These characteristics mean that there are higher costs associated with a poor reenlistment decision in the military and theory suggests that people will study it more carefully.

As with the civilian sector, studies of the military turnover process have tended to look at the impact of either economic variables (pay, SRBs, unemployment, etc.) or satisfaction variables on the reenlistment decision.

In one attempt to isolate the determinants of the reenlistment decision, Lakhani and Gilroy [Ref. 20] proposed a three way decision theoretical framework. Their concept was

that enlisted members are faced with three discrete choices toward the end of their term. They can reenlist, separate, or incur the short commitment of an extension. Individuals are likely to base their decision on the maximization of utility.

They estimated a multinomial logit regression model using data from the 1981 National Longitudinal Survey. The parameters of the model included economic variables (SRBs, pay ratio, and unemployment) and noneconomic variables (AFQT scores, race, number of dependents). This analysis produced results consistent with the researcher's a priori expectations. The coefficients of the SRB and military/civilian pay ratios were positive and significant for nearly every occupational category.

Hosek and Peterson [Ref. 21] later looked specifically at the SRB program. The study used data obtained from the Defense Manpower Data Center (DMDC) representing all four services and some 600 skills between 1976 and 1981. Like Lakhani and Gilroy, Hosek and Peterson used a polychotomous logit model to differentiate between reenlistments and extensions. Here the difference between reenlistments and extensions is significant because those who extend are not eligible for SRBs. Other than SRBs, the model used military/civilian pay ratio, unemployment rate, race and educational level as explanatory variables.

This research found SRBs to be a very powerful retention tool. As bonuses increase, reenlistments increase and extensions fall. Further, lump sum payments were found to be more cost effective than installment plans, at least for first term reenlistments.

One interesting conclusion drawn in this study was that members induced to stay by a bonus are more likely to leave upon completion of their term. This implies that the increased use of bonuses at the first and second terms would likely result in a smaller portion of people entering the over 10 year group. Thus, SRBs can be used to shape force structure.

Another study of the effectiveness of SRBs was conducted by Cymrot [Ref. 22], who examined the relationship between SRBs and the retention of Marine Corps enlisted personnel. Cymrot grouped 356 Military Occupation Specialties (MOS) into 22 families representing MOSSs of similar skills. These families were then further divided into length of service "zones" which determine the SRB multiple.

The Annualized Cost of Leaving (ACOL) approach, initially developed by John Warner and Gary Nelson of SRA Corporation, was then used to estimate the relationship between SRBs and reenlistment. This approach assumes a utility maximizing framework. That is, given a set of alternatives, an

individual will choose the one that yields the most satisfaction.

Cymrot found a strong statistical association between bonuses and reenlistments in nearly every combination of skill families and zones. Specifically, he predicted that reenlistments rates would increase by as much as 13.6% in Zone A (4-6 years of service) simply by increasing the SRB multiple from 0 to 1. In fact, no other factor included in the model (unemployment rate, net pay, rank, race) had the impact of bonus payments.

Baughman and Darnell [Ref. 23] continued to look at the issue of pay, but they also included in their model some measures of job satisfaction and organizational commitment.

Baughman and Darnell analyzed a survey of military members at Wright-Patterson Air Force Base, using multivariate ordinary least squares regression analysis.

This analysis indicated that pay inequity and job satisfaction did not influence career intent in the presence of organizational commitment. It did however, fail to address what organizational commitment is based upon. It seems reasonable to assume that job satisfaction and pay influence organizational commitment. Therefore, to say that pay and job satisfaction do not influence turnover in the face of organizational commitment ignores any correlation between these variables.

Thus far this review of military turnover literature has concentrated primarily on studies dealing with pay or other economic concerns. Another body of current literature specifically considers the impact of job satisfaction and demographic characteristics on the reenlistment decision. Of these, several have used data available in the 1985 DOD Survey of Officer and Enlisted Personnel, the survey used in Chapters III and IV of this thesis.

Reardon [Ref. 24] for example, attempted to analyze the relationship between factors known to affect the reenlistment decision. She grouped explanatory variables into three categories; demographic, intentions, and satisfaction. She then used a logit regression model to estimate the impact each set of variables had on the reenlistment behavior of enlisted members within 12 months of their decision point.

In a full model, using all three sets of variables, she found all intent variables, along with race, age, paygrade, marital status and overall job satisfaction, to be significant at the .90 level of significance. This model accurately predicted turnover 81% of the time.

Finn [Ref. 25] also used the 1985 DOD Survey of Officer and Enlisted Personnel but with a somewhat different purpose. Finn was concerned with the effects that job satisfaction, satisfaction with military life, and family environment had

on the reenlistment behavior of enlisted Marines and in how these factors differed across occupations.

Finn divided his sample into two occupational groups, combat arms and non-combat arms, and into two tenure groups, first term and second term. He then used a logit regression model to estimate parameters for each of the four groups of data as well as for the entire original data set.

The estimates from the full regression model showed time in service, rank, marital status, education, race, job satisfaction and chance of finding a new civilian job, all to be significant predictors of reenlistment. This model correctly predicted behavior 67.5% of the time. While differences did exist across occupations and terms of enlistment, job satisfaction, race and chance of finding a civilian job were consistently significant across all models.

One of the most unique analyses of the data collected in the 1985 DOD Survey of Officer and Enlisted Personnel was conducted by Hempel and Parschall [Ref. 26]. They used both the member and spouse versions of the survey to ask the questions, "Do intentions change over time?" and Does the spouse have a significant affect on the members retention decision?"

To accommodate this analysis, the data was stratified into groups with homogeneous times to separation. They then used a logit regression model to estimate a binary choice model,

reenlist or not. Hempel and Parschall found that enlistments increased from 43.69% in the first term to 91.6% for the third term. Further, they found that the factors influencing the reenlistment decision changed as the term of enlistment changed. For those on their first term (within six months of separation date) income and marital status were the most significant variables. Once on the second term of enlistment, time at sea and job satisfaction headed the list. For those on their third term of enlistment, only paygrade was significant.

While Hempel and Parschall concluded that spouse and family factors did indeed significantly influence the members reenlistment decision, the model tended to become unstable in terms of significant coefficients when these variables were added. This was especially true for the first term where no variable (other than intent) was significant at the .90 level of significance.

While these studies have served to increase our understanding of the factors affecting the retention decision, one area appears to have been, for the most part, ignored. That is the investigation of how the effects of these factors vary across occupational categories. While Finn [Ref. 25] did examine combat versus non-combat skills, little work has been done addressing specific occupational groups.

Two studies have attempted to do just that with Air Force occupations. The first was conducted by Lazar and Maloney [Ref. 27]. They began by looking at 16,000 responses to Air Force Quality of Life Surveys conducted between 1977 and 1980. They divided these responses into eight occupational categories of which five were made up of enlisted specialties. Factor analysis was then employed as a variable reduction technique and yielded six general categories of variables, job satisfaction, economic standing, health care satisfaction, job autonomy, institutionalism and satisfaction with free time.

Among the results of the analysis was that significant differences existed between the factors affecting career intent across the eight occupational categories. Education and race were the only explanatory variables that remained stable across all regressions. This result implies that the factors that are important to one group do not necessarily reflect the feelings of another group.

A second study that looked across Air Force Specialties was conducted by Saving and Stone for the Air Force Human Resources Laboratory [Ref. 28]. Their goal was to estimate the relationship between national economic conditions and the ability of the Air Force to retain people. Their analysis used longitudinal data contained in the Historical Airman Data File from 1974 to 1982. Explanatory variables were grouped as either demographic (race, tenure, education, marital status

and number of dependents) or market (employment data, industry wage, military compensation, CPI). By looking across specialties, Saving and Stone were able to include an industry specific wage rate.

A probit regression model was then used to estimate the influence each explanatory variable had on the reenlistment decision. This analysis yielded several interesting results. First, demographic variables were found to play a statistically weaker role (ie. the coefficients were smaller and less significant) in the explanation of reenlistments of those in their second term than those in their first term. Females were found to be more likely to reenlist in the first term but less likely the rest of the time. Race however, was the most significant demographic variable in every term of service. AFQT scores were inversly related to reenlistment likelihood which may be an indication of the higher opportunity costs of staying in the miliary paid by those with higher ability.

Also interesting were the results across occupational specialties. Like Lazar and Maloney [Ref. 27] Saving and Stone found considerably different effects across specializes. While some variables such as race and marital status, remained stable across specialties others, such as unemployment, did not. This may be the result of two intervening factors, SRB payments and retraining opportunities.

While there is still a lot of work to be done in the area of turnover research, one thing is apparent in current literature: continuing research into the turnover decision and the use of advanced statistical techniques (logit and probit for example) are improving our understanding of the factors which influence turnover behavior.

D. HUMAN CAPITAL THEORY AND THE TRAINING INVESTMENT

One of the goals of this thesis is to determine what impact the length of specialized skill training has on the retention decision. While there are several reasons one may want to study this impact, the primary reason here is cost. Today 58% of all active force training is specialized skill training. The projected cost of this training exceeds \$4.7 billion for 1990. The Department of Defense estimates that manpower requirements in support of training will be in excess of 176,000 manyears in 1990 [Ref. 29].

The question asked here is how these huge investments affect retention? Are the most thoroughly trained military members reenlisting or are they selling their skills in the private sector? Finn [Ref. 25] suggests that those who enlist for a specific type of training actually maximize the value of these incentives by using them as soon as possible, that is, by leaving at the end of the first enlistment. This is significant because in fiscal year 1988 entrance surveys

indicated that 78% of those who enlisted in the Air Force did so for training. Moreover, 92% listed training among their top three reasons.

Human capital theory suggests that a person whose skills command a relatively higher wage in the civilian community would be less likely to choose to stay in the military. The question then becomes one of who commands the higher relative wage? Does the military's investment in training increase the wage a worker can earn in the private sector, thus providing those with the most training the greatest incentive to separate?

In the human capital literature, training is usually divided into two major categories. General training is training useful in many firms besides those providing it. For example, a machinist trained in the Air Force finds his skills of value in steel and aircraft firms, as well as many others. Training that increases an individual's productivity only in the firm providing it is called specific training. In the military infantrymen and missile officers would be likely examples. Productivity in these skills is valued more highly in the military but not (much) elsewhere.

Most of the training offered in the military today is at least partly general. More than 85% of all enlisted specialties have a direct civilian counterpart [Ref. 30]. Particularly in the Air Force, training is nearly all general

because it does not train the classic infantryman or combat arms soldier. Indeed the Air Force combat jobs, pilots, have one of the most easily transferred skills.

This thesis will test the hypothesis that those with longer periods of initial training build larger stocks of human capital, have better civilian job opportunities, command a higher wage and are thus more likely to separate, all other things equal.

III. METHODOLOGY

A. SURVEY USED

The data used in this thesis were drawn primarily from the 1985 DOD Survey of Officer and Enlisted Personnel. [Ref. 31] The survey was conducted by the Defense Manpower Data Center for the Office of the Assistant Secretary of Defense, Force Management and Personnel. This survey was conducted in response to a mandate by the Deputy Secretary of Defense to survey military families who were increasingly recognized as important to the retention and readiness of the Armed Forces.

The survey was organized into nine sections: Military Information, Present and Past Locations, Reenlistment/Career Intent, Individual and Family Characteristics, Dependents, Military Compensation, Benefits and Programs, Family Resources and Military Life. The population from which the sample was drawn consisted of active duty officers and enlisted members who were stationed in the United States or overseas on 30 September 1984. Members considered new accessions, those with less than four months of service, were excluded from the population. The survey was administered to approximately 132,000 active duty officers and enlisted members stratified by service, length of service and sex.

The original sample consisted of 106,575 enlisted personnel of which 27,115 were Air Force personnel. The overall response rate for enlisted personnel was 70.1%, an unusually high response rate for surveys of this sort. The Air Force had the highest response rate at 76.7%.

In addition to the survey which contained responses to selected questions, the 5 July 1989 Enlisted Master File, which contains basic personnel information about those respondents still on active duty, and loss files, which contain the same information for those who have separated, were used. For this thesis the three files were merged based on Social Security number matches. This merged file also contained the actual enlistment behavior of survey participants. Those matched with loss files had separated and those matched with the Enlisted Master File, who had passed a reenlistment point, had reenlisted. In addition, the merged file contained personnel information for all matched records that was not in the survey but had been shown in past research to be significant to the reenlistment decision. This included, for example, SRB multiples, AFQT scores and length of enlistment term. Separation codes were also available which made it possible to distinguish between voluntary and involuntary separations.

Finally, the average civilian wage for each DOD occupation code was computed using data from the Civilian Master File

maintained by the Defense Manpower Data Center. This average wage was then appended to each survey record based on an occupation code match.

B. RESTRICTIONS IMPOSED

Because the most serious retention problems confronting the Air Force today are in the first and second terms, the data set included only Air Force first and second term enlisted members. As with any survey data, this sample contained erroneous responses or responses which made an individual record unusable for purposes of this analysis. Therefore, those who either didn't answer a question, or answered "don't know", were deleted. In addition, since the model presented in this chapter is meant to be one of voluntary behavior, all those who were separated either "for cause" (such as misconduct) or for medical reasons were deleted. Muchinsky and Tuttle [Ref. 11] suggest both empirical and theoretical reasons to look at those who quit and those who are fired individually. On the empirical level, the few studies that did separate the two groups found different results. On a theoretical level, the two groups differ in terms of who initiated the termination, with voluntary separation being a seemingly more exact representation of individual behavior.

Observations with variables with unrealistic values, such as a two year enlistment term, were removed. Finally, the data were age restricted to avoid the affect of atypical airmen; those under 17 years of age were removed from the sample. Those with no prior service who were either on their first term of enlistment and were over 34 years old, or on their second term of enlistment and were over 38 years old were also removed from the sample. The final data set contained 8,133 records.

C. DEVELOPMENT OF THE MODEL

Most models of the turnover process have included essentially the same variables. They have however, differed in their categorization of those variables and in their posited causal order. The theoretical model used in this thesis was based on several key findings. In their evaluation of the Mobley model of turnover, Miller *et al* found general categories of variables to be more consistent, when cross validating the model across samples, than very specific categories (categories representing general information as opposed to specific cognitive activities). They further found that Mobley's hypothesized lines of causality were supported only about half the time. This indicates that casual ordering of turnover precursors is possible. In addition, Arnold and Feldman found that all explanatory variables didn't influence

turnover through their impact on intention to quit. To use intention as a proxy for quit behavior then, may misstate the significance of explanatory variables on quit behavior. With these findings in mind, actual staying behavior (reenlistment) was modeled as a function of four categories of explanatory variables: demographic (such as sex and race), tenure (such as time in service), economic (such as wage alternatives) and cognitive (such as job satisfaction). Since the identical model is used throughout the analysis, it is presented here in general form. Individual variable definitions and their expected signs are discussed below.

$$\text{Reenlistment} = f(\text{Demographic}, \text{Tenure}, \text{Economic}, \text{Cognitive})$$

D. VARIABLE DEFINITIONS

Variables that were expected to affect the reenlistment decision were chosen based on the results of studies presented in the literature review and the authors own experience as an Air Force enlisted member. Explanatory variables were fit into one of four categories including tenure, demographic, cognitive and economic.

1. Dependent Variable (GAINLOSS)

The dependent variable is a dichotomous variable representing the actual reenlistment behavior of the individuals in the sample. The value is set equal to one if

the individual reenlisted and equal to zero if he separated. Table 2 presents a summary of all the explanatory variables and the direction in which they are expected to affect the dependent variable.

2. Tenure Variables

a. Time in Service (*TIME*)

Time in service, originally reported in months, is a measure of the member's total time on active duty. The data were converted to fractional years to aid in the interpretation of the coefficient. Job matching theory suggests that the matching process between people and jobs happens early in the relationship and that as a person builds tenure in an organization he becomes less likely to leave. A priori, then, this variable is expected to have a positive sign.

b. Prior Service (*PSERV*)

Prior service identifies those who were in some branch of military service, separated, and then rejoined the Air Force. The variable value was set equal to one if the member had prior service and zero if he did not. Since a prior service member retains credit for that service, this variable should act like a time variable. Those with prior service should be more likely to reenlist than those without.

TABLE 2
EXPLANATORY VARIABLES AND EXPECTED SIGNS

<u>Variable Name</u>	<u>Expected Sign</u>
Tenure	
TIME	+
PSERV	+
ENLTERM	+
PAYGRADE	+
TIMFRSEP	?
Demographic	
KIDS	+
MARSTAT	+
RACE	+
SEX	?
HISCHOL	-
SOMECELL	-
COLLGRAD	-
MENT	+
AGEATENT	+
Cognitive	
SATISF	+
METEXP	+
Economic	
INCOME	+
SPINC	-
CIVJOB	-
SRB	+
CIVALT	-
CORSLEN	-

c. Enlistment Term (ENLTERM)

Enlistment term measures the length of the term of obligated service for the term the member was on at the time of the survey. Both first and second term airmen can enlist for four, five or six years. Longer terms of service place a member's decision point closer to retirement eligibility. This variable was included to measure the potential "retirement affect" of the length of term of service.

d. Military Rank (*PAYGRADE*)

This variable is a continuous measure of a member's rank at the time of the survey. Human capital theory suggests that as an individual experiences wage increases (a function of rank in the military) he is less likely to quit his current job because quitting becomes more costly (in terms of lost pay) and better civilian alternatives become more scarce. This variable is expected to have a positive sign. As rank rises so should reenlistment likelihood.

e. Time From Separation (*TIMFRSEP*)

The survey used in this study was conducted at a point in time across a randomly selected sample representing individuals with differing lengths of service remaining on their enlistment contracts. This variable was included to allow this difference to be held constant while varying other characteristics. The variable was set equal to one if the member had less than one year remaining on his current contract, two if a member had less than two (but more than one) years remaining, and so on through six years remaining. The author had no preconceived ideas about the sign of this variable.

3. Demographic Variables

a. Number of Children (*KIDS*)

The survey asked respondents to report the number of children for whom they provided over half their support.

As Table 3 indicates, those who reported having one or more dependents exhibited similar retention behavior (65-75% reenlisted) but collectively different behavior from those who reported having no dependents (only 53% reenlisted). Therefore, this variable was dichotomized to equal one for those who had dependents and zero for those who did not. It is expected that as individuals gain more family responsibility they will be more apt to stay in the service because costs of quitting are higher, ceteris paribus. Therefore, this variable is expected to have a positive sign.

TABLE 3
CROSSTAB OF DEPENDENTS AND RETENTION

<u># of Kids</u>	<u>Reenlist</u>	<u>Separate</u>
0	53%	47%
1	65%	35%
2	70%	30%
3	70%	30%
4	72%	28%
5	74%	26%
> 5	70%	30%

b. Marital Status (*MARSTAT*)

The marital status variable was set equal to one for those who were married and to zero for those who were not. Those who reported their marital status as "married first

time", "remarried", or "separated" were coded as married. Those who reported their marital status as "widowed", "divorced", or "single" were coded as not married. Previous studies have shown that married individuals tended to have greater reenlistment rates than unmarried individuals [Ref. 24,25]. As with those who have dependents, married members may tend to feel increased family responsibility and elect to stay in the military for the benefits and job security. This variable is expected to have a positive sign.

c. Racial Origin (RACE)

The Race variable was set equal to zero if the member was white and one otherwise. Past studies have found that minorities tended to reenlist at greater rates than whites. This may be due to perceived reduced opportunities in the civilian community. This study is expected to confirm those results thus the variable should have a positive sign.

d. Sex of the Member (SEX)

The SEX variable equals one for females and zero for males. The expected effect of this variable is difficult to predict. Past research suggests however, that women may be more likely to quit than men.

*e. Educational Level of the Member
(HISCHOL, SOMECOLL AND COLLGRAD)*

For the purposes of this study the education variable was divided into four categories each represented

with a dummy variable: those with less than a high school education (the base case), those with a high school education (HISCHOL), those with some college but less than a bachelor's degree (SOMECCOLL), and those with at least a bachelor's degree (COLLGRAD). Those with greater amounts of education should on average, command a higher wage in the civilian job market than those with less education. As such, the opportunity costs associated with staying in the military should be higher for those with more education. Increased education should decrease the probability of reenlistment, other things equal.

f. Mental Category (MENT)

Mental categories are determined by percentile scores on the Armed Forces Qualification Test (AFQT). Mental Categories are determined as shown in Table 4.

TABLE 4
MENTAL CATEGORY AS A FUNCTION OF AFQT SCORES

<u>AFQT</u>	<u>MENTAL CATEGORY</u>
93-99	Category I
65-92	Category II
50-64	Category IIIA
31-49	Category IIIB
21-30	Category IVA
16-20	Category IVB
10-15	Category IVC
01-09	Category V

The variable was constructed using a one-to-one relationship with mental category. If the individual falls in mental

category I the value of the variable is one. If the individual falls in mental category II the value of the variable is two, and so on. As was the case with education, those with higher aptitudes should have greater opportunities in the civilian labor market than those with lower aptitudes. A priori then, the expected sign of this variable is positive.

*g. Age at Entry (**AGEATENT**)*

The age of the member at the time he came on active duty was computed by subtracting the length of active service from the age reported at the time of the survey. Human capital theory provides a hypothesis for the expected sign of this variable. In general, younger people have lower opportunity costs associated with job changes and longer periods over which to recoup those losses. Job matching theory suggests that older people may also tend to make more informed enlistment decisions based on more experience in the market place. Therefore, older people should be more likely to reenlist, other things equal.

4. Cognitive Variables

*a. Job Satisfaction (**SATISF**)*

This variable measures a member's overall satisfaction with the military as a way of life. The variable ranges from a value of one, representing "very dissatisfied", to a value of seven representing "very satisfied". Much of the research reviewed in Chapter II of this thesis suggests

a negative correlation between job satisfaction and turnover [Ref. 7, 24, 25]. For the purposes of this research, this relationship suggests that as job satisfaction increases the likelihood of reenlistment should increase, other things equal.

b. Met Expectations (*METEXP*)

Met expectations measure the degree to which life in the military is what the member expected. Members were asked to indicate their level of agreement with the statement, "life in the military is what I expected". Response values were coded so that the values ranged from one, meaning "strongly disagree" to a value of five, meaning "strongly agree". Porter and Steers [Ref. 5] suggest that those whose expectations have been met are more likely to stay than those whose expectations were not met.

5. Economic Variables

a. Total Taxable Family Income (*INCOME*)

In his research on the relationship between wages and turnover, Parsons [Ref. 16] found that as wages rose turnover fell. This variable, reported in discrete dollars, attempts to test this finding. Extending Parson's logic, as total income rises reenlistment should rise, ceteris paribus.

b. Income of the Member's Spouse (*SPINC*)

This variable measures, to the nearest dollar, the annual income of the military member's spouse. As the income

of the spouse rises, the member may be less likely to stay in the military because of the opportunity costs which occur when the member's spouse must change jobs. It is expected that this variable will have a negative sign.

c. Chance of Finding a Good Civilian Job (CIVJOB)

Studies by economists and psychologists alike have found that the perceived chance of finding an alternative job affects quit behavior. This variable measures the member's impression of his or her likelihood of finding a good civilian job. The variable ranges from one, a zero in ten chance of finding a civilian job, to 11 , a ten in ten chance of finding a civilian job. As the perceived chance of finding a civilian job rises, reenlistment likelihood should fall. Therefore, this variable should have a negative sign.

d. Selective Reenlistment Bonus (SRB)

Lakhani and Gilroy, Hosek and Peterson, and Cymrot all found positive relationships between Selective Reenlistment Bonuses and reenlistment likelihood. In fact, Cymrot [Ref. 22] found no other factor included in his model ad the affect of bonus payments as a predictor of actual behavior. The size of the SRB payment to the member is computed by multiplying a member's basic pay times the number of years for which the member agrees to reenlist and by some predetermined SRB multiple. This multiple is a function of the Air Force specialty in which the member serves. Since the

actual SRB can not be calculated, the variable used here is simply the size of the SRB multiple which ranges from zero to four. As this multiple rises so should reenlistment likelihood.

e. Alternative Civilian Pay (*CIVALT*)

Several studies have examined the turnover process within a utility maximization framework [Ref. 22,25]. Most of these studies define utility as a combination of pecuniary and nonpecuniary factors both in and outside the military. This variable attempts to measure the pecuniary factor outside the military by quantifying the pay alternatives confronting the member based on his or her particular skill. The variable was derived by using DOD occupation codes to match records on the civilian master file with like records on the file used in this thesis. When DOD occupation codes matched, the average annual civilian compensation was appended to the survey file. As the civilian compensation alternative rises, reenlistment likelihood should fall, all other things equal.

f. Course Length (*CORSLEN*)

One of the objectives of this thesis was to quantify the affect the initial training investment has on retention behavior. This variable measures the length of initial specialized skill training in fractional weeks of training. The information was obtained from the Quantitative Analysis and Training Costs Division, Headquarters, Air

Training Command (HQ ATC/ACCQ) and Air Force Regulation 50-5, Formal Schools. As discussed in Chapter II, human capital theory suggests that as the investment in training grows so should an individual's stock of productive capacity and, in turn, the wage that the individual commands. Thus, as the course length increases the individual is more invested in the job, and the probability of reenlistment should fall. This hypothesis assumes that training is all at least partly general and that market demands for skills are similar.

E. METHOD OF ANALYSIS

Multivariate data analysis was used to quantify the relationships between a set of explanatory variables and a binary choice dependent variable, reenlist or not. While there are several estimation techniques that are appropriate when using a dichotomous dependent variable, the one used here is the logit model. The model is based on the cumulative logistic distribution function. That is:

$$P_i = 1/(1+e^{-(\beta_i X_i)})$$

where P_i = the probability of reenlistment

X_i = a row vector of individual and Air Force specific characteristics

β_i = a column vector of parameters to be estimated

It can be shown that if P_i is the probability of reenlistment and $1-P_i$ is the probability of not reenlisting, then

$$L_i = \ln(P_i/(1-P_i)) = \beta_i X_i.$$

Here, Li , or the log of the odds ratio, is called the logit.[Ref. 32]

The logit model was chosen over alternative methods such as the linear probability model or the probit model for several reasons. First, unlike the linear probability model, the logit model restricts the probabilities to lie between zero and one while the logit itself remains unbounded. That is,

$$P_i \rightarrow 0 \text{ when } \beta_0 + \beta_1 X_i \rightarrow -\infty \quad \text{and} \quad P_i \rightarrow 1 \text{ when } \beta_0 + \beta_1 X_i \rightarrow +\infty.$$

Second, although the logit is linear in X , the probabilities themselves are not. This is in contrast to the linear probability model where the probabilities increase linearly with X [Ref. 32]. It is reasonable to assume that the change in probabilities will tend to taper off as the values of the explanatory variables increase or decrease indefinitely. One more year of service would probably not affect the reenlistment probability of a member with 16 years of service to the same extent that it would affect that of a member with two years of service.

Logit was chosen over probit primarily because it is less computationally involved. Maximum likelihood estimation (MLE) is used to estimate model coefficients. The software package used was SAS, release 5.18.

F. ESTIMATION PROCEDURE

The data were first stratified by term of service. A Chow test was performed to make an initial judgement about the similarity of the estimated parameters across terms of service. A Chow test is one method of testing for differences between several regressions. In this test the model is first estimated for the full sample and then for each subsample. Estimating the model for the full sample imposes the restriction that the coefficients of the subsamples are equal. Then each subsample is estimated independently, which imposes no restriction on the coefficients. An F test is then used as follows:

$$F = (S_5/K) / (S_4/(N_1 + N_2 + \dots + N_t - tK))$$

where S_4 = the sum of the individual residual sum of squares from all sub sample regressions.

S_5 = the residual sum of squares from the restricted model minus S_4

K = the number of parameters estimated

t = the number of sub samples

N = the sample size of the subsample

This computed F is then compared to a critical F value. If the computed value exceeds the critical value, the hypothesis that the regressions are the same may be rejected. Note that this test is based on OLS regression and not on the logit procedure.

Logit regression analysis was then applied to each term of service individually which allowed comparison of coefficients to assess differences between the factors affecting first and second term reenlistment behavior.

The data were then further stratified by occupation, as defined by the Department of Defense Occupation Conversion Manual [Ref. 33]. The ten major occupational groupings used are presented in Table 5. A Chow test was again performed on these samples to make an initial judgement about their similarity. Occupational group nine (Non-Occupational) was dropped from the analysis because many of these individuals did not possess any specific skill (ie. patient status, awaiting discharge, etc.) and because the population was so small.

The Air Force is concerned not only with the quality and experience distribution of the total force but with the manning levels of individual Air Force specialties. Therefore, performing separate analysis on individual occupational groupings using the same model will allow another key question to be answered: Do the factors affecting the behavior of one occupational group necessarily affect another occupational group?

TABLE 5
DOD OCCUPATIONAL GROUPS

GROUP	<u>Title</u>	N
0	Aircrew	335
1	Electronic Equipment Repairers	1130
2	Communications and Intelligence Spec.	637
3	Medical and Dental Specialists	632
4	Other Technical and Applied Spec.	314
5	Functional Support and Admin.	2509
6	Electrical/Mechanical Equip. Repairer	1484
7	Craftsmen	382
8	Service and Supply Handlers	694
9	Non-Occupational	16
	TOTAL	8133

IV. RESULTS OF ANALYSIS

A. GENERAL ANALYSIS

This chapter presents the results of the analysis described in chapter III. It will also interpret the results, in an attempt to answer the major research questions of this thesis. In order to evaluate the logit coefficients, it is important to remember that they represent the effect of a one unit change in the explanatory variable (X_i) on the log of the odds of the dependent variable. [Ref. 34] To estimate the effect of a unit change in X_i on the actual probability of reenlistment it can be shown that

$$\frac{\partial P}{\partial X_i} = \beta_i (P_i)(1-P_i)$$

where β_i = the variable coefficient

P_i = some base case probability.

For the purposes of this analysis, the base case probability was derived from the estimated logit equation using the reference groups for all categorical (dummy) variables and the mean values of the continuous variables. Descriptive statistics, including the mean value of all variables, are presented in Table 6.

There are several possible methods available to measure the overall goodness of fit of a model. One method that is appropriate when maximum likelihood estimation techniques are

used is called a likelihood ratio test. The test statistic is computed by dividing the value of the likelihood function when all parameters are set equal to zero by the value of the likelihood function at its maximum. The ratio has a chi-square distribution with the number of degrees of freedom equal to the number of estimated parameters.

The goodness of fit of each model was also measured by comparing the percentage of cases that the model predicted correctly to what Cymrot [Ref. 22] refers to as the naive method. In this comparison the actual characteristics of individuals are substituted into the model. If the predicted probability from the equation exceeds 0.5 the individual is predicted to stay. If it is less than 0.5 the individual is predicted to leave. A comparison is then made between the predicted outcomes and the actual outcomes. A prediction is considered correct when the actual and predicted outcomes are the same, and incorrect when they are different. The model is said to provide useful information when the predicted method is better than the naive prediction rule that everyone follows the majority [Ref. 22]. Tables presenting the results of each logit regression include a cross tabulation of predicted and actual results. As an example of this goodness of fit test consider Table 7. The naive method would predict that everyone reenlists, which would be 64% correct. Notice that the logit model accurately predicts 75.5% of the cases. The logit model outperformed the naive method in every case.

TABLE 6
DESCRIPTIVE STATISTICS

VARIABLE	N	MEAN	STD DEV	MIN VALUE	MAX VALUE
GAINLOSS	8133	0.646	0.478	0.000	1.000
INCOME	8133	17.251	9.509	3.614	192.385
SPINC	8133	1.738	5.052	0.000	90.000
TIME	8133	4.883	2.555	0.500	13.916
SRB	8133	0.289	0.693	0.000	4.000
CIVJOB	8133	7.656	2.713	1.000	11.000
METEXP	8133	3.308	0.989	1.000	5.000
SATISF	8133	4.653	1.565	1.000	7.000
KIDS	8133	0.436	0.495	0.000	1.000
MARSTAT	8133	0.606	0.488	0.000	1.000
RACE	8133	0.224	0.416	0.000	1.000
SEX	8133	0.465	0.498	0.000	1.000
HISCHOL	8133	0.568	0.495	0.000	1.000
SOMECELL	8133	0.389	0.487	0.000	1.000
COLLGRAD	8133	0.037	0.188	0.000	1.000
MYMENT	8133	6.214	1.014	2.000	8.000
TIMFRSEP	8133	2.661	1.078	1.000	4.000
ENLTERM	8133	4.180	0.575	4.000	6.000
PAYGRADE	8133	4.132	0.895	1.000	7.000
PSERV	8133	0.060	0.238	0.000	1.000
CORSLEN	8022	12.269	10.407	0.000	63.700
AGEATENT	8133	19.800	2.382	18.000	32.000
CIVALT	6299	22.613	4.135	14.411	32.702

B. FULL MODEL RESULTS

The purpose of this model is simply to identify the factors affecting the retention of first and second term Air Force enlisted members. The full model consists of 6253 observations (the SAS procedure used deleted some of the 8133 observations due to missing values) representing members in both their first and second terms, and all occupational groups. The dependent variable, GAINLOSS, represents a binary choice, reenlist or not. It was modeled as a function of

tenure, demographic, cognitive and economic variables. Table 7 lists the coefficients of each variable along with their associated standard errors and significance levels. The base case profile is a white male, single, with no children or prior service and less than a high school education. The base case reenlistment probability was .685. The effects of each explanatory variable on the probability of reenlistment are discussed below.

1. INCOME

This variable is significant at the 90% confidence level. Results indicate that as income rises one thousand dollars, reenlistment probability falls by 0.2 percent. This result is contrary to a priori expectations. It may simply indicate that those with relatively higher incomes have more "cushion" which to fall back on making separation a more viable alternative.

2. SPINC

Significant at the 90% confidence level, the results indicate that as spouse income rises one thousand dollars the probability of reenlistment falls by approximately 0.3 percent.

3. SRB

This variable measures the impact of a change in the SRB multiple itself. Those offered an SRB of multiple one were 4.1% more likely to reenlist than those who were paid no

bonus at all. However, those paid a bonus of multiple four were only 3% more likely to reenlist than those paid a bonus of multiple three. SRB is significant at the 99% confidence level.

4. TIME

As expected, the variable measuring time in service was positively signed and significant at the 99% confidence level. As the time an individual has in the service rises by one year, the probability of him or her reenlisting rises by 3.6%. Thus, since second term members have, on the average, four more years of service than members in their first term, the probability that a member in his second term reenlists exceeds that of a first term member by 14.4%. This result supports the job matching theory.

5. CIVJOB

Significant at the 99% confidence level, the negative sign on this coefficient suggests that an individuals perception of the civilian job market does matter. As the individual's perceived chance of finding a civilian job moves from a 7 in 10 chance to an 8 in 10 chance, the probability of reenlistment falls by 1.5%.

6. METEXP

The degree to which an individual's expectations of a job match the actual job was significant at the 90% confidence

TABLE 7
LOGISTIC REGRESSION ON WHOLE SAMPLE
6253 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-2.956	0.630	0.001*
INCOME	-0.009	0.005	0.062*
SPINC	-0.013	0.007	0.098*
SRB	0.191	0.057	0.001*
TIME	0.166	0.024	0.001*
CIVJOB	-0.068	0.011	0.001*
METEXP	0.062	0.032	0.059*
SATISF	0.299	0.021	0.001*
KIDS	0.057	0.072	0.426
MARSTAT	0.190	0.071	0.010*
RACE	0.695	0.076	0.001*
SEX	-0.504	0.070	0.001*
HISCHOL	-0.040	0.412	0.922
SOMECELL	-0.240	0.414	0.561
COLLGRAD	-0.601	0.443	0.175
MENT	-0.050	0.031	0.109
TIMFRSEP	0.372	0.028	0.001*
AGEATENT	0.032	0.013	0.018*
ENLTERM	0.150	0.056	0.007*
PAYGRADE	0.175	0.063	0.005*
PSERV	0.640	0.138	0.001*
CORSLEN	-0.002	0.004	0.536
CIVALT	-0.029	0.008	0.000*

Model Chi-square = 1077.98 with 22 D.F.

* Significant at the 90% confidence level.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	1183	1015	2198
	POSITIVE	520	3535	4055
	TOTAL	1703	4550	6253

SENSITIVITY: 87.2% SPECIFICITY: 53.8% CORRECT: 75.5%

level. This suggests that the concept of a realistic job preview may indeed matter to our enlisted folks.

7. SATISF

Without exception, every study reviewed for this thesis which considered satisfaction as an explanatory variable found it to have positive and significant affects on staying behavior. These results are once again confirmed by this study. Overall satisfaction was significant at the 99% confidence level. As an individual moves from being indifferent to being somewhat satisfied, his probability of reenlistment rises by 6.5%.

8. KIDS

While the sign of this variable suggests that those with more children tend to stay in the military at greater rates than those without children, the coefficient is not statistically significant.

9. MARSTAT

Those who are married do tend to reenlist at greater rates than those who are unmarried. The probability that a married member reenlists exceeds that of an unmarried person by 4.1%. This variable was significant at the 95% confidence level.

10. RACE

Past research suggests that minorities may tend to stay in the military at greater rates than whites because of

perceived reduced civilian job opportunities. This research confirms those findings. Indeed based on computed partial affects, Race is the single strongest variable in this model. The probability that a minority will reenlist is 15% greater than the probability that a white person will reenlist. This variable is significant at the 99% confidence level.

11. SEX

Women have tended to exhibit lower labor force participation rates than men. They also tend to have more broken participation patterns. As such, it is reasonable to expect women to stay in the military at lower rates than men. The negative and significant sign of the sex variable confirms this hypothesis. The probability that a woman will reenlist is 10.9% lower than the probability that a man will reenlist.

12. HISCHOL, SOMECOLL, COLLGRAD

These dichotomous variables were included to test the theory that those with more education have better civilian job opportunities and, as a result, tend to leave the military at greater rates. As compared to the reference group of those with less than a high school education, this theory can not be supported. While each variable exhibits a negative sign, consistent with a priori expectations, none are statistically significant.

13. MENT

Results indicate that those in higher mental categories may tend to leave the Air Force at greater rates than those in lower mental categories. However, this variable is only significant below the 11% confidence level.

14. TIMFRSEP

The time from separation variable does play a significant role in the reenlistment decision. Since those coded as one made their reenlistment decision in 1985 while those coded as four made their reenlistment decision in 1989, this variable may be a trend variable. This result indicates that the trend, between 1985 and 1989, was that, other things equal, people became more apt to stay in the military.

15. AGEATENT

As expected, the older a person is when he comes in the Air Force, the more likely he is to stay. A person who enlists at age 20 is 0.7% more likely to reenlist than a person who enlists at age 19. This variable is significant at the 95% confidence level.

16. ENLTERM

Those who enlist for more than four years are more likely to reenlist than those who reenlist for just four years. This result supports the idea of a pension affect. Longer terms of service place members closer to retirement (and the benefits associated with military retirement) at the

decision point than do shorter terms. This "pension affect" may induce people to reenlist at greater rates than they otherwise might.

17. PAYGRADE

The positive and significant sign of the paygrade variable suggests that the more senior in rank an individual is the more apt he is to stay in the Air Force. An E-5, for example, is 3.8% more likely to stay than an E-4, ceteris paribus.

18. PSERV

Results indicate that a person who enlists in the Air Force with prior service is 13.8% more likely to reenlist than a non prior service enlistee. Like enlistment term, this result may indicate a retirement affect. Since prior service time represents credit toward retirement, those with prior service are closer to retirement at the end of an enlistment than those without prior service. In addition, those with prior service enter the Air Force with first hand experience with some military service. As such they may enlist with a much clearer picture of what military life represents.

19. CORSLEN

Course length was negatively signed indicating that those who attend longer initial specialty skills training may be more likely to separate than those who attend shorter

courses. However, this variable is not statistically significant in this model.

20. CIVALT

The civilian alternative pay variable is negatively signed, as expected, and significant at the 99% confidence level. This result confirms the hypothesis that as a member's civilian pay alternative rises, his probability of reenlistment falls. Evaluated at the mean, a \$1000 increase in civilian pay alternatives reduces the probability of reenlistment by 0.6%.

C. TWO TERM ANALYSIS RESULTS

1. Initial Comparison

The purpose of this analysis was first to identify those factors which tend to remain significant to the reenlistment decision across terms of service, and second, to identify those factors whose effects tend to change across terms of service. To support this analysis, the sample was divided into two sub samples, one representing those on their first term of service ($n = 4734$) and the other representing those on their second term of service ($n = 3754$).

OLS regressions were first run on each subsample and on the full sample to accommodate a Chow test. The test resulted in a computed F statistic of 11.87 and a critical F

statistic of 1.79, which resulted in the rejection of the null hypothesis that the regressions were the same for both samples.

The model used in part A of this chapter was then estimated for each subsample using the logit technique. The results of this estimation are presented in Tables 8 and 9. This was done so that the signs and significance of explanatory variables could be compared across terms of service. These estimates resulted in a first term base case reenlistment probability of .422 and a second term base case probability of .90. The cross tabulations in Tables 8 and 9 show that in both terms, the model outperformed the naive method. In the first term the model correctly classified 71% of the cases while the naive method only predicts 52.5% of the cases correctly. In the second term the model correctly classified 84.3% of the cases while the naive method correctly classified only 75% of the cases.

2. Variable Comparison

A comparison of coefficients across terms of service shows that while the signs and significance of some variables do indeed change across terms of service, others are consistently significant and signed as expected across terms. For example, although relatively small, CIVJOB is negatively signed and significant in both cases indicating that civilian job market perceptions are important to both samples. SATISF

is positively signed and significant with a much larger coefficient in both models than that of CIVJOB. This not only indicates that job satisfaction is a consistent determinant of reenlistment behavior but that it is a more powerful determinant than CIVJOB. The RACE variable shows that minorities tend to reenlist at greater rates than whites in both terms while the SEX variable shows that women tend to reenlist at lower rates than men in both terms. TIMFRSEP, thus far considered a trend variable, implies that the affect of this trend are positive and significant in both terms.

Several variables appear to be insignificant for both samples. These include METEXP, KIDS and AGEATENT. While the signs of the categorical variables representing educational level (HISCHOL, SOMECOLL, and COLLGRAD) tended to randomly change from one model to the next, none of the coefficients can be considered statistically significantly different from zero.

Somewhat more interesting to study are the variables whose signs and significance tend to change across terms of service. Several of the differences may well be due simply to less variance in the second term sample. For example, MARSTAT was significant and positive in the first term but insignificant in the second term. This may be caused by the fact that in the first term some 53% of the sample was unmarried while in the second term only 27.4% of the sample

was unmarried. PAYGRADE exhibits similar change. While in the first term paygrades are distributed across six levels, E-1 through E-6, and tend to form a normal distribution pattern around the E-3 and E-4 grades, 95% of the second term sample was at the E-4 and E-5 paygrades. Finally, MENT is negative and significant in the first term but insignificant in the second. While still potentially a homogeneity problem, the implications here are disturbing. Past research has suggested that the best people tend to leave the service first. This result supports that idea. Mental category significantly affects retention behavior in the first term. Those in the higher mental categories tend to separate at greater rates than those in lower mental categories. As a result, the high end of the distribution (of mental categories) is essentially cut off. Now we have a less heterogeneous sample representing lower mental categories overall. In the data set employed in this thesis, 79% of the first term sample were in mental categories I-IIIA while only 18% were in category IIIB. However, in the second term, only 68% were in categories I-IIIA and 20% were in category IIIB.

Not all the differences between terms can be attributed to sample homogeneity. SPINC, for example, was insignificant in the first term but significant and negative in the second term. The income distribution of second term spouses tended to be higher than a similar distribution in the

first term. This suggests that spouses of members on their second term make more money than spouses of members on their first term. As such, the hardship of frequent moves may impose greater costs in terms of lost spouse income on second term families than on first term families.

SRB multiples had a positive and significant affect in the first term but a negative and significant affect in the second term. In a study conducted by the Rand corporation, Gotz and McCall [Ref. 35] suggest that those who are induced to remain in the Air Force by a bonus leave after receipt of the bonus. This conclusion is supported here. It may take an even larger bonus in the second term to get people to stay.

ENLTERM was also positive and significant in the first term but negative and significant in the second term. This may also be due to an SRB affect. Because SRB payments are, among other things, a function of how long the member agrees to reenlist for, those paid SRBs tended to reenlist for six years at greater rates than those who were not paid SRBs (11% versus 2%).

CORSLEN was negative and significant in the first term but insignificant in the second term. This result supports the hypothesis that those who receive more training may build larger stocks of productive capacity, command a higher civilian wage, and thus separate at higher rates than those with relatively less training. By the time an individual has

TABLE 8
LOGISTIC REGRESSION ON FIRST TERM SAMPLE
2915 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-3.476	0.894	0.001*
INCOME	-0.018	0.008	0.030*
SPINC	0.001	0.012	0.931
SRB	2.006	0.225	0.001*
TIME	0.004	0.05	0.935
CIVJOB	-0.083	0.015	0.001*
METEXP	0.041	0.045	0.371
SATISF	0.305	0.030	0.001*
KIDS	0.053	0.116	0.646
MARSTAT	0.304	0.107	0.004*
RACE	0.777	0.110	0.001*
SEX	-0.190	0.095	0.046*
HISCHOL	0.427	0.574	0.456
SOMECELL	0.212	0.577	0.712
COLLGRAD	-0.017	0.624	0.977
MENT	-0.114	0.047	0.015*
TIMFRSEP	0.386	0.065	0.001*
AGEATENT	0.031	0.021	0.137
ENLTERM	0.270	0.079	0.001*
PAYGRADE	0.350	0.103	0.001*
PSERV	1.148	0.251	0.001*
CORSLEN	-0.010	0.007	0.041*
CIVALT	-0.039	0.011	0.001*

Model Chi-square = 555.14 with 22 D.F.

* Significant at the 90% confidence level.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	937	446	1383
	POSITIVE	398	1134	1532
	TOTAL	1335	1580	2915

SENSITIVITY: 74.0% SPECIFICITY: 67.8% CORRECT: 71.0

TABLE 9
LOGISTIC REGRESSION ON SECOND TERM SAMPLE
3338 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-1.804	1.107	0.103
INCOME	0.008	0.007	0.263
SPINC	-0.033	0.010	0.001*
SRB	-0.345	0.068	0.001*
TIME	0.314	0.042	0.001*
CIVJOB	-0.054	0.016	0.001*
METEXP	0.072	0.050	0.148
SATISF	0.287	0.031	0.001*
KIDS	0.108	0.096	0.259
MARSTAT	-0.053	0.114	0.639
RACE	0.589	0.110	0.001*
SEX	-0.900	0.112	0.001*
HISCHOL	-0.521	0.775	0.501
SOMECOLL	-0.755	0.776	0.330
COLLGRAD	-1.228	0.807	0.128
MENT	0.012	0.045	0.792
TIMFRSEP	0.433	0.053	0.001*
AGEATENT	0.018	0.019	0.326
ENLTERM	-0.338	0.120	0.005*
PAYGRADE	0.123	0.100	0.218
PSERV	0.218	0.170	0.199
CORSLEN	0.000	0.007	0.900
CIVALT	-0.009	0.012	0.438

Model Chi-square = 403.47 with 22 D.F.

* Significant at the 90% confidence level.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	367	448	815
	POSITIVE	76	2447	2523
	TOTAL	443	2895	3338

SENSITIVITY: 97.0% SPECIFICITY: 45.0% CORRECT: 84.3

moved into the second term of enlistment the length of initial skills training is no longer significant. By this time members may have experienced a successful job match. Also, the effect of retirement benefits becomes stronger.

D. MULTIPLE OCCUPATION ANALYSIS RESULTS

1. Initial comparison

The Air Force is concerned not only with its total force manning levels but also with ensuring that the correct number of people are in each occupational specialty. As such, the purpose of this analysis was to first identify those factors which tend to be significant to the reenlistment decision for all occupational groups, and second, to identify those factors whose affects tend to change across occupational groups. Are the factors that are important to one occupational group necessarily important to other occupational groups? To support this analysis, the sample was divided into ten subsamples representing each of the major occupational groups presented in Table 5. OLS regressions were then run on each occupation unique sub sample, again to accommodate a Chow test to determine whether or not the coefficients were the same. The test resulted in a computed F statistic of 14.2 and a critical F statistic of 1.79, which results in the rejection of the null hypothesis that the regression parameters were the same for all subsamples. The results of

logit analysis for each subsample are presented in Tables 10 through 18. Cross tabulations show that in every case the model out performed the naive method.

2. Variable Comparison

As with the comparison across terms of service, this comparison across occupational groups shows that while the signs and significance of some variables do change across occupations, others remain significant and signed as expected across occupations. TIME, for example, is positively signed and significant in six of the nine models, and at least correctly signed in the remaining three. This result indicates that as time in service rises the probability of reenlistment rises in all occupational groups. RACE and SEX exhibited similar behavior. That is, both variables are significant and signed as expected across all occupational groups. Women are less likely to reenlist than men and minorities are more likely to reenlist than whites in every occupation. Likewise, SATISF and CIVJOB were fairly consistent across occupational groups. While CIVJOB did exhibit a negative sign (contrary to a priori expectations) for occupational group seven, the coefficient for this group was insignificantly different from zero. This result suggests that satisfaction with military life and perceived civilian job opportunities are important factors in everyone's reenlistment decision. The TIMFRSEP variable was also

positive and significant in nearly every group. This "trend" implies that as time passed from 1985 to 1989, people were more likely to reenlist in all occupations, ceteris paribus.

While the variables discussed thus far were significant to the reenlistment decisions of all groups, INCOME and MENT were not significant to any group. Several other variables were only significant in a very small number of cases. SPINC, for example, was only significant for communications and intelligence specialists. This variable was signed as expected in six of the nine models. METEXP was correctly signed and significant only for medical and dental personnel and craftsmen. These skills may involve duties and conditions of service in the military that are considerably different than the duties one normally associates with these occupations, especially at the lower pay grades. KIDS and MARSTAT were each significant in only two models. Both variables were correctly signed in seven of the nine models. Each of the three dummy variables included to measure the effect of differing levels of education (HISCHOL, SOMECELL, and, COLLGAD) were significant only for Electrical and Mechanical Equipment Repairers. In this case the variable was signed as expected. Those with higher levels of education did tend to leave the service at greater rates than those with relatively lower levels of education. ENLTERM was significant and positively signed only for Electrical and Mechanical

Equipment Repairers and Service and Supply Handlers. This variable was however, positively signed in all but one occupational group.

SRB was negatively signed and significant (meaning that the SRB multiple rises reenlistment falls) for the Functional Support and Administration and Craftsmen samples. This result may be a sample phenomenon in that some 71% of each of these samples represented second term airmen. Recall from section B of this chapter, that it may take larger SRBs in the second term to get people to reenlist who were induced by a bonus in the first term. More interesting is how the effects of an SRB payment tended to vary across the remaining groups. Computed partial affects of increasing an SRB payment from multiple zero to multiple one ranged from insignificant in some samples to as high as 14% for Electronics Technicians. That is, changing the SRB multiple from zero to one increases the probability of reenlistment for Electronics Technicians by 14%.

AGEATENT was significant and positively signed for Craftsmen, Functional Support and Administration and Service and Supply Handlers. This may be due to the nature of the work these people tend to perform. Each of these functions has only a distant relationship with the core mission of the Air Force, to fly and fight. If young people enlist with a vision of F-16s and flight lines but end up in jobs that have

only a distant relationship to this mission, they may be disappointed with their situation and leave.

PAYGRADE was positively signed in five of the eight occupational groups but negative and significant for Electronic Equipment repairers. There are two possible explanations for this result. First, the opportunities in the civilian job market for those in the more senior paygrades may be quite high for Electronic Equipment Repairers. Second, there may be some correlation between the actual abilities that command higher wages in the civilian job market and the abilities that lead to promotion as an Electronic Equipment Repairer.

PSERV was positive and significant for Functional Support and Administration and for Electrical and Mechanical Equipment Repairers. It was negative and significant for Electronic Equipment Repairers. Perhaps there is some threshold level of experience beyond which more private sector jobs open up.

CIVALT was positively signed and significant (as civilian pay alternative rises reenlistment rises) for Functional Support and Administration and for Other Technical and Applied Specialists. Again this may be a function of the job. People in these jobs tend to enjoy the best working conditions in the Air Force. As such, it may take more than money to get them to leave the service. In addition, these

skills tended to have slightly lower relative civilian pay alternatives than the other occupational groups.

Also interesting was how the impact of civilian pay changed across occupational groups. In those samples where the coefficient was negatively signed, the affect on reenlistment probability ranged from insignificantly different from zero to as much as a 7.6% increase in reenlistment probability. This may indicate not only differences in relative pay alternatives but differing market demand for skills as well.

CORSLEN was positive and significant only for Electronic Equipment Repairers. As discussed with regard to the PAYGRADE variable, these skills tend to have a number of potentially valuable upgrade or follow-on courses. Using initial skills training may not be a valid representation of the training an Electronic Equipment Repairer receives on his first two terms of service. This variable was however, negative and significant for both Electrical and Mechanical Equipment Repairers and Craftsmen. This result suggests that the longer the initial skills training the more apt a member is to separate, ceteris paribus.

TABLE 10
LOGISTIC REGRESSION ON OCCUPATIONAL GROUP ZERO
AIRCREW
230 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-0.016	43.326	0.999
INCOME	-0.018	0.057	0.748
SPINC	-0.119	0.081	0.146
TIME	0.412	0.194	0.033*
SRB	9.628	.	.
CIVJOB	-0.177	0.088	0.043*
METEXP	-0.143	0.213	0.502
SATISF	0.557	0.141	0.001*
KIDS	0.099	0.508	0.845
MARSTAT	0.652	0.516	0.205
RACE	0.695	0.533	0.192
SEX	9.796	.	.
HISCHOL	-7.509	.	.
SOMECELL	-8.467	.	.
COLLGRAD	.	.	.
MENT	-0.171	0.202	0.395
TIMFRSEP	1.023	0.222	0.001*
ENLTERM	0.173	0.218	0.428
PAYGRADE	0.688	0.401	0.092*
PSERV	0.135	1.341	0.919
CORSLEN	.	.	.
AGEATENT	0.067	0.116	0.563
CIVALT	.	.	.

Model Chi-square = 85.12 with 22 D.F.

* Significant at the 90% confidence level.
'.' Software was unable to estimate coefficient.

CLASSIFICATION TABLE

PREDICTED

	NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	60	22
	POSITIVE	21	127
	TOTAL	81	149

SENSITIVITY: 85.8% SPECIFICITY: 73.2% CORRECT: 81.3

TABLE 11
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP ONE
 ELECTRONIC EQUIPMENT REPAIRMEN
 372 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	7.725	7.220	0.284
INCOME	0.028	0.029	0.328
SPINC	-0.060	0.040	0.140
TIME	0.299	0.098	0.002*
SRB	1.043	0.158	0.001*
CIVJOB	-0.108	0.062	0.080*
METEXP	0.098	0.159	0.539
SATISF	0.346	0.105	0.001*
KIDS	0.322	0.360	0.371
MARSTAT	0.147	0.364	0.685
RACE	0.654	0.425	0.124
SEX	-1.187	0.382	0.001*
HISCHOL	0.377	0.845	0.655
SOMECELL	0.477	0.800	0.551
COLLGRAD	.	.	.
MENT	-0.202	0.201	0.316
TIMFRSEP	0.217	0.139	0.117
ENLTERM	0.237	0.221	0.284
PAYGRADE	-0.585	0.312	0.061*
PSERV	-2.158	0.833	0.009*
CORSLEN	0.054	0.014	0.001*
AGEATENT	-0.042	0.067	0.528
CIVALT	-0.350	0.254	0.169

Model Chi-square = 145.32 with 21 D.F.

* Significant at the 90% confidence level.

'.' Software was unable to estimate coefficient.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	133	40	173
	POSITIVE	41	158	199
	TOTAL	174	198	372

SENSITIVITY: 79.4% SPECIFICITY: 76.9% CORRECT: 78.2%

TABLE 12
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP TWO
 COMMUNICATIONS AND INTELLIGENCE SPECIALISTS
 192 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-16.821	110.589	0.879
INCOME	0.041	0.040	0.309
SPINC	-0.103	0.062	0.094*
TIME	0.192	0.144	0.184
SRB	0.365	0.143	0.011*
CIVJOB	-0.030	0.077	0.688
METEXP	0.166	0.194	0.390
SATISF	0.147	0.135	0.276
KIDS	0.066	0.402	0.860
MARSTAT	-0.303	0.480	0.527
RACE	0.648	0.465	0.163
SEX	-0.770	0.489	0.115
HISCHOL	17.847	.	.
SOMECCOLL	17.764	.	.
COLLGRAD	17.564	.	.
MENT	-0.249	0.216	0.249
TIMFRSEP	0.132	0.175	0.451
ENLTERM	0.125	0.365	0.731
PAYGRADE	-0.376	0.385	0.328
PSERV	8.675	.	.
CORSLEN	0.016	0.068	0.812
AGEATENT	0.071	0.098	0.471
CIVALT	-0.065	0.043	0.130

Model Chi-square = 58.51 with 22 D.F.

* Significant at the 90% confidence level.

'.' Software was unable to estimate coefficient.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE]	45	27	72
	POSITIVE]	15	105	120
	TOTAL]	60	132	192

SENSITIVITY: 87.5% SPECIFICITY: 62.5% CORRECT: 78.0

TABLE 13
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP THREE
 HEALTH CARE SPECIALISTS
 529 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-0.681	2.896	0.814
INCOME	0.001	0.015	0.915
SPINC	-0.025	0.024	0.286
TIME	0.247	0.086	0.004*
SRB	-0.844	0.679	0.214
CIVJOB	-0.110	0.038	0.004*
METEXP	0.228	0.111	0.039*
SATISF	0.228	0.073	0.001*
KIDS	0.292	0.252	0.246
MARSTAT	-0.000	0.251	0.997
RACE	0.677	0.259	0.009*
SEX	-0.494	0.248	0.047*
HISCHOL	1.433	1.462	0.326
SOMECCOLL	1.539	1.456	0.290
COLLGRAD	0.465	1.487	0.754
MENT	0.008	0.135	0.952
TIMFRSEP	0.242	0.106	0.023*
ENLTERM	0.324	0.231	0.161
PAYGRADE	-0.234	0.234	0.317
PSERV	0.710	0.497	0.153
CORSLEN	0.036	0.036	0.324
AGEATENT	-0.005	0.043	0.899
CIVALT	-0.197	0.100	0.050*

Model Chi-square = 97.12 with 22 D.F.

* Significant at the 90% confidence level.
 . . Software was unable to estimate coefficients.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	90	98	188
	POSITIVE	46	295	341
	TOTAL	136	393	529

SENSITIVITY: 86.5% SPECIFICITY: 47.9% CORRECT: 72.8

TABLE 14
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP FOUR
 OTHER TECHNICAL AND APPLIED SPECIALISTS
 308 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-4.236	23.664	0.857
INCOME	-0.008	0.019	0.680
SPINC	0.036	0.039	0.355
TIME	0.163	0.105	0.122
SRB	1.114	0.323	0.001*
CIVJOB	-0.126	0.057	0.027*
METEXP	-0.118	0.166	0.475
SATISF	0.346	0.104	0.001*
KIDS	0.352	0.359	0.326
MARSTAT	0.034	0.374	0.926
RACE	0.664	0.396	0.093*
SEX	-1.436	0.353	0.001*
HISCHOL	-2.697	23.535	0.908
SOMECELL	-3.149	23.534	0.893
COLLGRAD	-2.573	23.541	0.912
MENT	0.157	0.164	0.339
TIMFRSEP	0.308	0.129	0.017*
ENLTERM	0.201	0.309	0.513
PAYGRADE	-0.001	0.282	0.996
PSERV	0.768	0.668	0.249
CORSLEN	-0.036	0.036	0.314
AGEATENT	0.025	0.064	0.693
CIVALT	0.168	0.066	0.011*

Model Chi-square = 72.81 with 22 D.F.

* Significant at the 90% confidence level.

'.' Software was unable to estimate coefficients.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	70	41	111
	POSITIVE	28	169	197
	TOTAL	98	210	308

SENSITIVITY: 85.8% SPECIFICITY: 63.1% CORRECT: 77.6%

TABLE 15
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP FIVE
 FUNCTIONAL SUPPORT AND ADMINISTRATION
 2129 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-4.635	1.251	0.001*
INCOME	-0.012	0.008	0.145
SPINC	0.006	0.013	0.625
TIME	0.133	0.041	0.001*
SRB	-0.500	0.135	0.001*
CIVJOB	-0.076	0.019	0.001*
METEXP	0.060	0.056	0.282
SATISF	0.264	0.036	0.001*
KIDS	0.191	0.123	0.121
MARSTAT	0.073	0.128	0.568
RACE	0.854	0.124	0.001*
SEX	-0.366	0.122	0.002*
HISCHOL	0.165	0.671	0.805
SOMECCOLL	0.071	0.674	0.915
COLLGRAD	0.144	0.730	0.843
MENT	-0.009	0.056	0.868
TIMFRSEP	0.389	0.052	0.001*
ENLTERM	0.030	0.107	0.773
PAYGRADE	0.208	0.112	0.064*
PSERV	0.623	0.266	0.019*
CORSLEN	0.012	0.026	0.632
AGEATENT	0.030	0.019	0.099*
CIVALT	0.065	0.038	0.088*

Model Chi-square = 305.41 with 22 D.F.

* Significant at the 90% confidence level.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	320	339	659
	POSITIVE	135	1335	1470
	TOTAL	455	1674	2129

SENSITIVITY: 90.8% SPECIFICITY: 48.6% CORRECT: 77.7%

TABLE 16
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP SIX
 ELECTRICAL AND MECHANICAL EQUIPMENT REPAIR
 1425 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	0.458	1.968	0.815
INCOME	-0.024	0.015	0.107
SPINC	-0.021	0.019	0.269
TIME	0.199	0.059	0.001*
SRB	0.140	0.146	0.337
CIVJOB	-0.028	0.023	0.234
METEXP	-0.008	0.074	0.910
SATISF	0.350	0.046	0.001*
KIDS	0.195	0.169	0.247
MARSTAT	0.497	0.173	0.004*
RACE	0.680	0.189	0.003*
SEX	-0.654	0.175	0.001*
HISCHOL	-1.965	1.133	0.083*
SOMECCOLL	-2.355	1.139	0.038*
COLLGRAD	-4.170	1.323	0.001*
MENT	-0.069	0.066	0.298
TIMFRSEP	0.407	0.058	0.001*
ENLTERM	0.299	0.149	0.044*
PAYGRADE	0.259	0.143	0.071*
PSERV	0.904	0.259	0.001*
CORSLEN	-0.038	0.019	0.050*
AGEATENT	0.035	0.033	0.291
CIVALT	-0.111	0.041	0.007*

Model Chi-square = 325.20 with 22 D.F.

* Significant at the 90% confidence level.

CLASSIFICATION TABLE

		PREDICTED		TOTAL
		NEGATIVE	POSITIVE	
TRUE	NEGATIVE	302	194	496
	POSITIVE	122	807	929
	TOTAL	424	1001	1425

SENSITIVITY: 86.9% SPECIFICITY: 60.9% CORRECT: 77.8%

TABLE 17
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP SEVEN
 CRAFTSMEN
 378 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	0.489	27.343	0.985
INCOME	-0.032	0.024	0.192
SPINC	0.007	0.044	0.861
TIME	0.183	0.118	0.121
SRB	-0.911	0.523	0.081*
CIVJOB	0.014	0.052	0.778
METEXP	0.229	0.135	0.100*
SATISF	0.445	0.100	0.001*
KIDS	-0.612	0.350	0.080*
MARSTAT	0.642	0.450	0.063*
RACE	1.213	0.405	0.002*
SEX	-0.311	0.353	0.378
HISCHOL	-5.790	.	.
SOMECELL	-6.406	.	.
COLLGRAD	-9.957	.	.
MENT	-0.105	0.144	0.464
TIMFRSEP	0.549	0.133	0.001*
ENLTERM	-0.147	0.257	0.566
PAYGRADE	0.504	0.298	0.090*
PSERV	0.557	0.579	0.335
CORSLEN	-0.040	0.031	0.089*
AGEATENT	0.102	0.054	0.101
CIVALT	-0.044	0.146	0.760

Model Chi-square = 107.59 with 22 D.F.

* Significant at the 90% confidence level.

'.' Software was unable to estimate coefficients.

CLASSIFICATION TABLE

PREDICTED

	NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	91	53
	POSITIVE	37	197
	TOTAL	128	250

SENSITIVITY: 84.2% SPECIFICITY: 63.2% CORRECT: 76.2%

TABLE 18
 LOGISTIC REGRESSION ON OCCUPATIONAL GROUP EIGHT
 SERVICE AND SUPPLY HANDLERS
 690 OBSERVATIONS

VARIABLE	BETA	STD. ERROR	P
INTERCEPT	-8.634	2.032	0.001*
INCOME	0.006	0.016	0.705
SPINC	-0.032	0.026	0.221
TIME	0.207	0.074	0.005*
SRB	7.434	.	.
CIVJOB	-0.021	0.030	0.496
METEXP	0.087	0.096	0.363
SATISF	0.346	0.061	0.001*
KIDS	-0.008	0.205	0.968
MARSTAT	0.017	0.217	0.935
RACE	0.178	0.216	0.411
SEX	-0.559	0.208	0.007*
HISCHOL	1.908	1.284	0.137
SOMECELL	1.700	1.288	0.187
COLLGRAD	1.182	1.384	0.392
MENT	0.004	0.095	0.961
TIMFRSEP	0.268	0.086	0.001*
ENLTERM	0.215	0.132	0.087*
PAYGRADE	0.132	0.190	0.487
PSERV	-0.005	0.447	0.989
CORSLEN	0.001	0.035	0.963
AGEATENT	0.085	0.041	0.040*
CIVALT	0.041	0.040	0.298

Model Chi-square = 116.11 with 22 D.F.

* Significant at the 90% confidence level.
 .'.' Software was unable to estimate coefficient.

CLASSIFICATION TABLE

PREDICTED

		NEGATIVE	POSITIVE	TOTAL
TRUE	NEGATIVE	162	111	273
	POSITIVE	73	344	417
	TOTAL	235	455	690

SENSITIVITY: 82.5% SPECIFICITY: 59.3% CORRECT: 73.3

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This thesis investigated the factors which influence the retention decisions of Air Force enlisted members with respect to term of service and major occupational group. While the directions of the effects of most variables were consistent with a priori expectations, there were significant differences in the magnitudes and levels of significance from one term to the next and from one occupational group to the next. This suggests that policies to improve retention which affect all people equally may not be as efficient as policies which target specific groups of people. Therefore, while some retention issues may be dealt with on a macro level, others should be dealt with on a micro level.

The Air Force has little or no control over some of the factors used as explanatory variables in the models examined in this research. These include the chance of finding a good civilian job and civilian pay alternatives. While policy makers should remain aware of how these factors affect retention and how they vary over time, the remainder of this section will concentrate on those factors that the Air Force can control through recruiting policy or personnel programs.

Factors which the Air Force can control and which had

similar effects on the retention probability of all groups were sex, race, age, TIMFRSEP, and overall satisfaction. Recruiting policy can affect sex, race, age and TIMFRSEP. Race is important because minorities tended to have a 15% greater probability of reenlisting than white people. Sex is important because women tended to have a 10.9% lower probability of reenlisting than men. This result suggests that, using retention as the only measure of effectiveness, advertising dollars may be better spent trying to attract minorities rather than women. The services now actively recruit women as an alternative to the traditional white male. A more cost effective population to target may be minorities. This result further implies that a goal of proportional representation by sex and race may not be the minimum cost method of staffing the Air Force. Political considerations aside, it may be less expensive to over represent minorities and under represent women.

The trend variable also had similar effects across different groups of people. The significance of the trend variable suggests that policy makers should not assume that retention behavior remains constant over time. Reenlistment probabilities may change over time because of changing job opportunities or because of the world situation as a whole. Public opinion of the military and its role may also affect retention over time. Therefore, recruiting policies aimed at

advertising should attempt to project the Air Force image as one of a "high tech" service whose goal is the preservation of peace.

Finally, since older people tended to stay at slightly greater rates than younger people (a person who was 20 years old when he enlisted is 0.7% more likely to reenlist than a person who was 19 years old at enlistment) the Air Force may want to examine the total cost of recruiting them. Older people may, however, turn out to be a more expensive alternative because the effect of age on reenlistment probability was small and the cost of maintaining an older force may be higher due to larger families, more medical expenses, etc.

While recruiting policies can be used to affect the factors discussed so far, personnel policies can be used to affect others. Foremost among these is overall satisfaction. Overall satisfaction with the military was the most consistent variable, in terms of sign and significance, across all models. This implies that satisfaction is an important determinant in the retention decision of all members. A person who is satisfied with the Air Force was 6.5% more likely to reenlist than a person who is indifferent about the Air Force. This suggests that personnel policies should be aimed at improving the overall quality of life enjoyed by the enlisted staff. This may include not only satisfaction with

a job but everything from satisfaction with the quality of service a person receives from a staff agency to the quality of base housing.

Personnel policies can also be used to affect those factors whose effect tended to vary from one group of people to the next. These include SRB payments, paygrade, marital status and spouse's income. Consider, for example, the effect of SRBs. These results indicate that an SRB will increase the probability of reenlistment for electronics technicians by 9.2% but will have no effect on the retention of medical and dental personnel. This difference may be caused by the lucrative opportunities awaiting electronics technicians in the private sector relative to those awaiting medical and dental personnel. If it is money that is causing electronics technicians to separate, money, in the form of bonuses, may induce them to stay. On the other hand, money may not be as important to the reenlistment decision of medical and dental personnel so the returns to the Air Force from paying a bonus are smaller. Therefore, SRBs should continue to be targeted to specific occupations to ensure the money is spent as efficiently as possible.

The effects of paygrade varied in terms of both magnitude and direction. This suggests that, as was the case with SRBs, an improved personnel policy may allow promotion rates to vary from one function to the next. Perhaps policy should be

tailored to offer people in skills in which paygrade has a positive and significant effect, a somewhat higher promotion opportunity than those people in skills where paygrade has a relatively small or negative effect.

Marital status significantly increased the retention probability of those on their first term. Those who were married were 4.1% more likely to reenlist than those who were unmarried. Therefore, the Air Force should continue to develop its family programs, especially those aimed at younger people such as Family Services and variable child care fees. Spouse's income, on the other hand, was significant to the retention decision of only those on their second term. This suggests that the Air Force should either increase the emphasis on programs aimed at reducing the frequency of moves, like the Variable Stabilized Base of Preference Program, or take steps to ease the burden of relocating spouses who work. Some of the personnel and data structures to do this already exist. One indication was the Spouse Sponsorship Program tested by the Strategic Air Command in 1985. The goal of this program was to match spouses with spouses at the gaining location who worked in similar fields. The work load demands on the people managing the program were minimal and the existing personnel data system easily accommodated the program. The information was simply made a part of the existing sponsorship program.

Of the factors whose effect tended to change from one group to the next, two have recruiting policy implications. They are the length of initial skills training and enlistment term. Retention in the first term was significantly affected by the length of initial skills training. This suggests that varying the length of initial service obligations may be warranted. Those who attend longer courses would incur longer initial service obligations. Further, since the length of the enlistment term positively affected retention probability in the first term, programs encouraging longer voluntary initial terms should be pursued. For example, offering those who enlist for six years one or two stripes upon completion of basic training will cost only a small amount in basic pay (they're promoted to E-2 normally in six months and the pay difference is minimal) and will increase their reenlistment probability by 13.2%.

B. AREAS OF FUTURE RESEARCH

As with most empirical research, this study leaves room for additional research. Some specific areas for future research are discussed below.

A better picture of the civilian labor market may shed more light on how this market affects retention. Specifically, future research into the factors affecting retention decisions should include some measure of regional

unemployment. Additionally, the civilian pay alternative used in this study was limited in scope to just civil servants. The pay scale of civil servants may not be representative of the true alternatives an enlisted member is confronted with at the end of a term of service. With the data being collected in the 1990 Census, and a crosswalk tape being developed by DMDC, future research may be able to include a more accurate estimate of true civilian pay alternatives and any effect differentials have on reenlistment decisions.

While differences in the factors affecting retention were identified across term of service and occupational group, future research should look across occupational groups for specific terms individually. That is, examine a sample of just first term members stratified by occupational group. This would allow for more precise estimates of how these factors tend to vary for specific groups at specific times.

This research also suggests that, from a retention point of view, minorities and older people may be more cost effective than women or younger people respectively. Future research should compare the total cost of these population pools including costs associated with recruiting, attrition and retention.

Overall satisfaction also appears to affect the probability of reenlistment. However, no attempt was made here to identify what makes up satisfaction. Future research

may want to examine what causes satisfaction or dissatisfaction and how each component affects the retention decision.

Marital status also appears to affect retention although why is not as clear. A more thorough look at the factors that make up marital status may yield more concrete policy alternatives. That is, does the spouse's satisfaction with military life matter or do services become more important? Finally, to fully evaluate the impact of individuals with different amounts and kinds of training, future research should include not only initial skills training but some measure of cumulative training across each member's career.

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